Total Maximum Daily Load

Evaluation

for the

St. Marys River

in the

St. Marys River Basin

for

Dissolved Oxygen

Submitted to:
The U.S. Environmental Protection Agency
Region 4
Atlanta, Georgia

Submitted by:
The Georgia Department of Natural Resources
Environmental Protection Division
Atlanta, Georgia

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Table of Contents

List of Tables

List of Figures

List of Appendixes

EXECUTIVE SUMMARY

The State of Georgia assesses its water bodies for compliance with water quality standards criteria established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed water bodies are placed into one of three categories with respect to designated uses: 1) supporting, 2) partially supporting, or 3) not supporting. These water bodies are found on Georgia's 305(b) list as required by that section of the CWA that defines the assessment process, and are published in *Water Quality in Georgia* every two years. This document is available on the Georgia Environmental Protection Division (GA EPD) website.

Some of the 305(b) partially and not supporting water bodies are also assigned to Georgia's 303(d) list, also named after that section of the CWA. Water bodies on the 303(d) list are required to have a Total Maximum Daily Load (TMDL) evaluation for the water quality constituent(s) in violation of the water quality standard. The TMDL in this document is based on the draft 2004 303(d) listing, which is also available on the GAEPD website. The TMDL process establishes the allowable pollutant loadings or other quantifiable parameters for a water body based on the relationship between pollutant sources and in-stream water quality conditions. This allows water quality-based controls to be developed to reduce pollution and to restore and maintain water quality.

The State of Georgia has identified one stream segment, located in the St. Marys River Basin, as water quality limited due to dissolved oxygen (DO). The St. Marys River from Catfish Creek to Millers Branch in Camden County was included in the State's draft 2004 303(d) list. This report presents the dissolved oxygen TMDL for this segment.

Part of the TMDL analysis is the identification of potential source categories. Sources are broadly classified as either point or nonpoint sources. A point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Nonpoint sources are diffuse, and generally, but not always, involve accumulation of oxygen demanding substances on land surfaces that wash off as a result of storm events.

The process of developing the dissolved oxygen TMDL for the St. Marys River Basin included developing computer models for the listed segment. Georgia Estuary, a steady-state tidally averaged water quality model developed by the GA EPD, was used for the estuary segments that are influenced by tidal actions. These models were calibrated to data collected in the St. Marys River Basin in the summer of 2003.

Management practices may be used to help reduce and/or maintain the Ultimate Oxygen Demand (UOD) loads. These include:

- Compliance with the requirements of the NPDES permit program; and
- Application of Best Management Practices (BMPs) appropriate to nonpoint sources.

The amount of oxygen demanding substances delivered to a stream is difficult to determine. However, by requiring and monitoring the implementation of these practices, such efforts will improve stream water quality and represent a beneficial measure of TMDL implementation.

1.0 INTRODUCTION

1.1 Background

The State of Georgia assesses its water bodies for compliance with water quality standards criteria established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed water bodies are placed into one of three categories with respect to designated uses: 1) supporting, 2) partially supporting, or 3) not supporting. These water bodies are found on Georgia's 305(b) list as required by that section of the CWA that defines the assessment process, and are published in *Water Quality in Georgia* every two years. This document is available on the GA EPD website

Some of the 305(b) partially and not supporting water bodies are also assigned to Georgia's 303(d) list, also named after that section of the CWA. Water bodies on the 303(d) list are required to have a Total Maximum Daily Load (TMDL) evaluation for the constituent(s) in violation of the water quality standard. The TMDL in this document is based on the draft 2004 303(d) listing, which is also available on the GA EPD website. The TMDL process establishes the allowable pollutant loadings or other quantifiable parameters for a water body based on the relationship between pollutant sources and in-stream water quality conditions. This allows water quality-based controls to be developed to reduce pollution and to restore and maintain water quality.

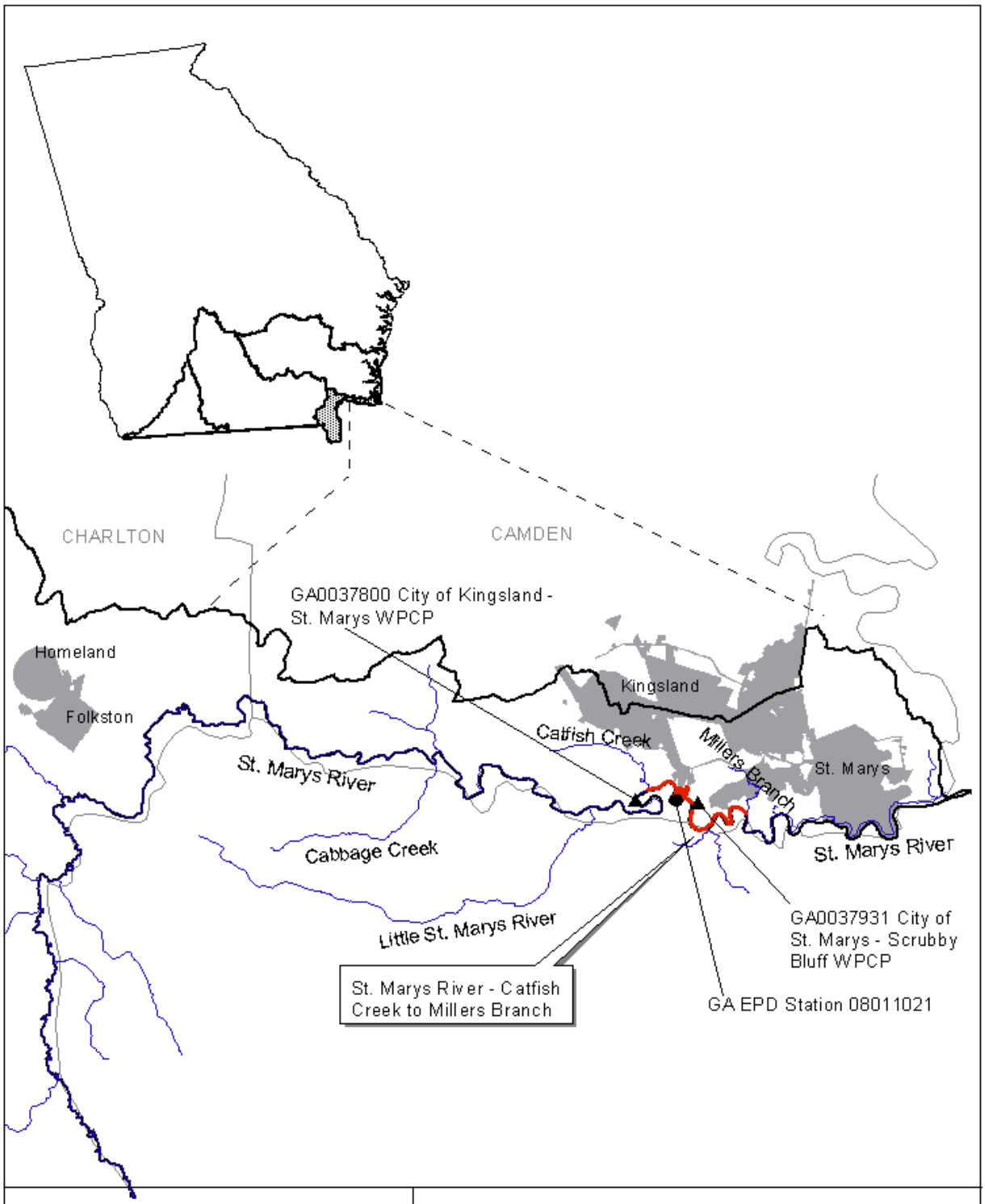
The State of Georgia has identified one stream segment located in the St. Marys River Basin as water quality limited due to dissolved oxygen (DO). This waterbody was included in the State's draft 2004 303(d) list. This report presents the DO TMDL for the listed segment in the St. Marys River Basin identified in Table 1.

1.2 Watershed Description

The St. Marys River basin is located in the southeastern part of Georgia, occupying an area of approximately 1,500 square miles with approximately 765 square miles of the basin in Georgia. The basin lies within the Coastal Plain physiographic province, which extends throughout the southeastern United States. The St. Marys River drains into the Atlantic Ocean.

The St. Marys River Basin is comprised of one USGS Hydrologic Unit Code (HUC), 03070204. Figure 1 shows the location of the listed dissolved oxygen segment in the St. Marys River Basin.

The land use characteristics of the St. Marys River Basin watersheds were determined using data from the National Land Cover Dataset (NLCD) for Georgia. This coverage is based on Landsat Thematic Mapper digital images developed in 1995. The classification is based on a modified Anderson level one and two system. Table 2 lists the land cover distribution and associated percent land cover.



TMDL Evaluation - Dissolved Oxygen
St. Marys River Basin

Figure 1. Impaired Stream Segment in HUC 03070204

Table 1. Waterbody Listed For Dissolved Oxygen in the St. Marys River Basin

Stream Segment	Location	Segment Length (miles)	Designated Use	Listing
St. Marys River	Catfish Creek to Millers Branch (Camden Co.)	6	Fishing	NS

Note:
NS = Not Supporting designated use

1.3 Water Quality Standard

The water use classification for the listed stream segment in the St. Marys River Basin is Fishing. The criterion violated is listed as dissolved oxygen, and the potential cause listed is urban runoff. The use classification water quality standards for dissolved oxygen, as stated in Georgia's *Rules and Regulations for Water Quality Control* (GA EPD, 2004), Chapter 391-3-6-.03(6)(c)(i) are:

> A daily average of 5.0 mg/L and no less than 4.0 mg/L at all times for waters supporting warm water species of fish.

Certain waters of the State may have conditions where dissolved oxygen is naturally lower than the numeric criteria specified above and therefore cannot meet these standards unless naturally occurring loads are reduced or streams are artificially or mechanically aerated. This is addressed in Georgia's *Rules and Regulations for Water Quality Control*, Chapter 391-3-6-.03(7) (GA EPD, 2004):

> *Natural Water Quality*. It is recognized that certain natural waters of the State may have a quality that will not be within the general or specific requirements contained herein. These circumstances do not constitute violations of water quality standards. This is especially the case for the criteria for dissolved oxygen, temperature, pH and fecal coliform. NPDES permits and Best Management Practices will be the primary mechanisms for ensuring that the discharges will not create a harmful situation.

EPA dissolved oxygen criteria are used to address these situations. Alternative EPA limits are defined as 90 percent of the naturally occurring dissolved oxygen concentration at critical conditions (USEPA, 1986).

> Where natural conditions alone create dissolved oxygen concentrations less than 110 percent of the applicable criteria means or minima or both, the minimum acceptable concentration is 90 percent of the natural concentration.

Accordingly, if the naturally occurring DO exceeds GA EPD numeric limits at critical conditions, then the GA EPD numeric limits apply. If naturally occurring DO is lower than the GA EPD numeric limits, then 90% of the natural DO will become the minimum allowable.

Table 2. St. Marys River Basin Land Coverage

Stream/Segment	Land use Categories - Acres (Percent)													
	Open Water	Residential	High Intensity Commercial, Industrial, Transportation	Bare Rock, Sand, Clay	Quarries, Strip Mines, Gravel Pits	Transitional	Forest	Row Crops	Pasture, Hay	Other Grasses (Urban, recreational; e.g. parks, lawns)	Woody Wetlands	Emergent Herbaceous Wetlands	Total	Land use Source
St. Marys River – Catfish Creek to Millers Branch	4,680	6,070	1,386	167	60	56,354	290,958	4,716	807	160	210,389	24,158	599,905	NLCD
	(0.8)	(1.0)	(0.2)	(0.0)	(0.0)	(9.4)	(48.5)	(0.8)	(0.1)	(0.0)	(35.1)	(4.0)		

2.0 WATER QUALITY ASSESSMENT

Stream segments are placed on the 303(d) list as partially supporting or not supporting their water use classification based on water quality sampling data. A stream is placed on the partial support list if more than 10% of the samples exceed the dissolved oxygen criteria and on the not support list if more than 25% of the samples exceed the standard.

During 2003, the Georgia EPD collected water quality data at EPD Station 08011021 on the St. Marys River at Interstate 95 (Figure 1). Appendix A provides the water quality data for this station, and includes DO and temperature data. In general, these data show that low dissolved oxygen values usually occurred during the summer months.

All field data relevant to the St. Marys River Basin were compiled by GA EPD and included in electronic database files. The data are managed using either the Water Resources Database (WRDB), a software database that was developed by GA EPD, or the EXCEL database management software.

3.0 SOURCE ASSESSMENT

An important part of the TMDL analysis is the identification of potential source categories. Sources are broadly classified as either point or nonpoint sources. A point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Nonpoint sources are diffuse, and generally, but not always, involve accumulation of oxygen demanding substances on land surfaces that wash off as a result of storm events.

3.1 Point Source Assessment

Title IV of the Clean Water Act establishes the National Pollutant Discharge Elimination System (NPDES) permit program. Basically, there are two categories of NPDES permits: 1) municipal and industrial wastewater treatment facilities, and 2) regulated storm water discharges.

3.1.1 Wastewater Treatment Facilities

In general, industrial and municipal wastewater treatment facilities have NPDES permits with effluent limits. These permit limits are either based on federal and state effluent guidelines (technology-based limits) or water quality standards (water quality-based limits).

EPA has developed technology-based limits, which establish a minimum standard of pollution control for municipal and industrial discharges without regard for the quality of the receiving waters. These are based on Best Practical Control Technology Currently Available (BPT), Best Conventional Control Technology (BCT), and Best Available Technology Economically Achievable (BAT). The level of control required by each facility depends on the type of discharge and the pollutant.

EPA and the States have also developed numeric and narrative water quality standards. Typically, these standards are based on the results of aquatic toxicity tests and/or human health criteria and include a margin of safety. Water quality-based effluent limits are set to protect the receiving stream. These limits are based on water quality standards that have been established for a stream based on its intended use and the prescribed biological and chemical conditions that must be met to sustain that use.

Municipal and industrial wastewater treatment facilities' discharges may contribute oxygen-demanding substances to the receiving waters. There are two (2) NPDES permitted discharges with effluent limits for oxygen consuming substances identified in the St. Marys River Basin watershed upstream from or within the listed segment. One of these discharges is classified as major, with a discharge of 1.0 million gallons per day (MGD) or more. Figure 1 provides the locations of NPDES discharges and Table 3 provides the permitted flows, as well as the 5-day Biochemical Oxygen Demand (BOD_5), ammonia (NH_3), and DO concentrations for the municipal treatment facilities.

Combined sewer systems convey a mixture of raw sewage and storm water in the same conveyance structure to the wastewater treatment plant. These are considered a component of municipal wastewater treatment facilities. When the combined sewage and storm water exceed the capacity of the wastewater treatment plant, the excess is diverted to a combined sewage overflow (CSO) discharge point. There are no permitted CSO outfalls in the St. Marys River Basin.

Table 3. NPDES Facilities in the St. Marys River Basin

Facility Name	NPDES Permit No.	Receiving Stream	NPDES Permit Limits			
			Average Monthly Flow (MGD)	Average Monthly BOD_5 (mg/L)	Average Monthly NH_3 (mg/L)	Minimum DO (mg/L)
St. Marys River Basin						
City of Kingsland – St. Marys WPCP	GA0037800	St. Marys River	2.2	30	17.4	2
City of St. Marys – Scrubby Bluff WPCP	GA0037931	Casey Creek, tributary to St. Marys River	0.5	20[1]	5.0[1]	5

Note:
1 Permit values for the months of May through October.

3.1.2 Regulated Storm Water Discharges

Some storm water runoff is covered under the NPDES Permit Program. It is considered a diffuse source of pollution. Unlike other NPDES permits that establish end-of-pipe limits, storm water NPDES permits establish controls "to the maximum extent practicable" (MEP). Currently, regulated storm water discharges that may contain oxygen demanding substances consist of those associated with industrial activities, including construction sites one acre or greater, and large, medium, and small municipal separate storm sewer systems (MS4s) that serve populations of 50,000 or more.

Storm water discharges associated with industrial activities are currently covered under a General Storm Water NPDES Permit. This permit requires visual monitoring of storm water discharges, site inspections, implementation of BMPs, and record keeping.

Storm water discharges from MS4s are very diverse in pollutant loadings and frequency of discharge. At present, all cities and counties within the state of Georgia that had a population of greater than 100,000 at the time of the 1990 Census are permitted for their storm water discharge under Phase I. This includes 60 permittees, with about 45 located in the greater Atlanta metro area. Phase I MS4 permits require the prohibition of non-storm water discharges (i.e., illicit discharges) into the storm sewer systems and controls to reduce the discharge of pollutants to the maximum extent practicable, including the use of management practices, control techniques and systems, as well as design and engineering methods (Federal Register, 1990). A site-specific Storm Water Management Plan (SWMP) outlining appropriate controls is required by and referenced in the permit. There are no Phase I MS4s in the St. Marys River Basin.

As of March 10, 2003, small MS4s serving urbanized areas are required to obtain a storm water permit under the Phase II storm water regulations. An urbanized area is defined as an entity with a residential population of at least 50,000 people and an overall population density of at least 1,000 people per square mile. Thirty counties and 56 communities within the state of Georgia are permitted under the Phase II regulations. There are no counties or communities located in the St. Marys River Basin that are covered by the Phase II General Storm Water Permit.

3.1.3 Confined Animal Feeding Operations

Confined livestock and confined animal feeding operations (CAFOs) are characterized by high animal densities. This results in large quantities of fecal material being contained in a limited area. Processed agricultural manure from confined hog, dairy cattle, and select poultry operations is generally collected in lagoons. It is then applied to pastureland and cropland as a fertilizer during the growing season, at rates that often vary monthly. Runoff during storm events may carry surface residual containing oxygen demanding substances to nearby surface waters.

In 1990, the State of Georgia began registering CAFOs. Many of the CAFOs were issued land application or NPDES permits for treatment of wastewaters generated from their operations. The type of permit issued depends on the operation size (i.e., number of animal units). There are no CAFOs located in the St. Marys River Basin that are registered or have land application permits.

3.2 Nonpoint Source Assessment

In general, nonpoint sources cannot be identified as entering a waterbody through a discrete conveyance at a single location. Typical nonpoint sources of oxygen demanding substances come from materials being washed into the rivers and streams during storm events. Constituents may wash off of land surfaces and either: 1) are flushed out of the system along with the water column flow; or 2) are settled out and become part of the stream channel bottom.

In this manner, historic wash off of settleable materials accumulates and exerts sediment oxygen demand (SOD). Constituents of concern from surface washoff include the fractions of ammonia and BOD_5 that become an integral part of channel bottom sediments, thus becoming a potential source of SOD. Table 2 provides the land cover distributions for the listed St. Marys River watershed. These data show that the watershed is predominately forested, with 48.5 percent forest land use. Woody wetlands is the next predominate land use, accounting for 35.1 percent of the watershed.

In addition to nonpoint sources of SOD associated with land disturbing activities, most of the streams in the St. Marys River Basin receive significant natural contributions of oxygen demanding organic materials from local wetlands and forested stream corridors. The following sources of naturally occurring organic materials have been identified:

- Adjacent wetlands, swamps, and marshes with organically rich bottom sediments; and
- Direct leaf litterfall onto water surfaces and adjacent floodplains from overhanging trees and vegetation.

Leaf litterfall is a major contributor to the amount of dissolved organic matter in the stream water column and the amount of SOD being exerted. Many streams in southern Georgia are also referred to as “blackwater” streams because of highly colored humic substances leached from surrounding marshes and swamps. In addition, low dissolved oxygen in blackwater streams is very common in the summer months when the temperatures are high and the flows are low (Meyer, 1992). The oxygen demanding effects of leaf litterfall are reflected in two ways: 1) by lowering the DO saturation of water entering the channel from adjacent swampy areas caused by decaying vegetation; and 2) by increasing SOD associated with vegetation decaying on stream channel bottoms.

3.2.1 Land Application Systems

Many smaller communities use land application systems (LAS) for treatment of their sanitary wastewater. These facilities are required through LAS permits to treat all their wastewater by land application and are to be properly operated as non-discharging systems that contribute no runoff to nearby surface waters. However, runoff during storm events may carry surface residual containing oxygen demanding substances to nearby surface waters. Some of these facilities may also exceed the ground percolation rate when applying their wastewater, resulting in surface runoff. If not properly bermed, this runoff, which contains oxygen demanding substances, may discharge to nearby surface waters. There is one permitted LAS system located in the St. Marys River Basin at the U.S. Navy Base at Kings Bay in Camden County. This facility has a permitted flow of 1.5 MGD.

4.0 TECHNICAL APPROACH

The first step of the technical approach for this TMDL is to select the model that can be effectively used to analyze the St. Marys River DO resources. After the appropriate model is selected, data is gathered to develop and calibrate the model. The calibrated model is then used to establish the TMDL during critical conditions. The modeling approach is described in the following sections.

4.1 Model Selection and Structure

Various analyses were performed to correlate the measured low DO concentrations to basic causes such as point and nonpoint contributions, flow conditions, stream and watershed characteristics, seasonal temperature effects, and others. From these analyses, the low DO values were found to coincide with high temperatures. Inflows of very low DO waters from adjacent marshes compounded the situation. Based on the geographic, hydrologic, and water quality characteristics of the St. Marys River, and considering that it is tidally influenced, Georgia Estuary was selected as the appropriate model for the listed stream segment.

USGS quadrangle maps and navigational maps, along with Arcview and MapInfo spatial graphics files, were used to develop drainage areas, stream lengths, bed slopes, segment geometry, and other physical input data for each model. Appendix B provides a summary of the model structure.

4.1.1 Georgia Estuary

Georgia Estuary is a one-dimensional water quality model developed by GA EPD. This model may be used for saline estuaries, as well as non-saline tidal rivers where both freshwater flow and tidal mixing are significant mechanisms in the transport of wastes in the water. Georgia Estuary is a steady state tidally averaged water quality model. The concentrations in the estuary vary spatially, but are assumed to be constant in time. Because an estuary has cyclical tidal variations that effect depth, cross-sectional area, and volume, an average mean water model is developed that is the average of the high water and low water slack tides.

In Georgia estuaries, the natural DO can drop below the freshwater standard of 5.0 mg/L. The Coastal DO Criteria for fishing use classification is given in Table 4.

Table 4. Coastal DO Criteria for Fishing Use Classification

If the natural DO is		The Maximum Allowable DO Deficit (mg/L)
Greater than or equal to (mg/L)	But less than (mg/L)	
2.0	3.0	0.1
3.0	3.3	Never less than 3.0 mg/L
3.3	4.0	0.3
4.0	5.0	0.4
5.0	5.5	0.5
5.5	---	Never less than 5.0 mg/L

Georgia Estuary models are tidally averaged and cannot accept model segments lateral to the main channel. One Estuary model was developed to represent the tidally influenced listed segment of the St. Marys River from Catfish Creek to Millers Branch.

4.2 Model Calibration

The model calibration period was determined from an examination of the GA EPD 2003 water quality data for the listed segment. The data examined included streamflow, DO and water temperature. The combination of the lowest DO and highest water temperature defined the critical modeling period.

For the listed segment, June 2003 was found to be the critical period. The calibration models were run to simulate an average DO from this period. The average summer DO was 3.2 mg/L (ranging from 2.9 mg/L to 3.7 mg/L) at an average summer temperature of 28 ^{o}C (ranging from 27.3 ^{o}C to 28.5 ^{o}C). Headwater and tributary water quality boundaries were developed from these instream field data, expected low DO saturation values (Meyer, 1992), and GA EPD standard modeling practices (GA EPD, 1978).

Average monthly discharge flows, BOD_5, NH_3, and DO concentrations for the discharges were obtained from June 2003 Discharge Monitoring Reports (DMRs). These data were input into the calibration model. BOD_5 was converted to $CBOD_U$ by multiplying by an f-ratio of 2 if the BOD_5 is greater than 20 mg/L and an f-ratio of 3 if the BOD_5 is 20 mg/L or less (GA EPD, 1978). Ammonia was converted to $NBOD_U$ by multiplying by 4.57. Table 5 provides a summary of the actual discharges from these facilities for June 2003.

Table 5. Summary of NPDES Discharges during 2003

Facility Name	NPDES Permit No.	Actual Discharge for June 2003			
		Flow (MGD)	BOD_5 (mg/L)	NH_3 (mg/L)	DO (mg/L)
City of Kingsland - St. Marys WPCP	GA0037800	1.75	10	16.9	5.44
City of St. Marys - Scrubby Bluff WPCP*	GA0037931	0	N/A	N/A	N/A

* The City of St. Marys - Scrubby Bluff WPCP facility, although permitted to discharge to Casey Creek, has not yet gone online.

In shallow streams, SOD is an important part of the oxygen budget. However, there are no field SOD measurements in the St. Marys River Basin. In the South 4 Basins, there are several SOD measurements that ranged from 0.9 to 1.9 g/m^2/day. An examination of South 4 SOD results was performed in order to develop realistic SOD values that could be applied to the St. Marys Estuary model. An SOD value of 0.95 g/m^2/day was adopted for the St. Marys River model.

The kinetic rates and input parameters developed during model calibration are provided in Table 6. These parameters include the carbonaceous BOD (CBOD) decay rate, nitrogenous BOD (NBOD) decay rate, SOD rate, and the Tsivoglou reaeration coefficient used to determine stream reaeration. In addition, GA Estuary requires a dispersion coefficient.

Table 6. Modeling Parameters

Parameter	GA Estuary Values

CBOD Decay Rate (1/day)	0.08
NBOD Decay Rate (1/day)	0.1
SOD (g/m^2/day)	0.95
Reaeration Coefficient	0.16-0.19
Dispersion Coefficient (mi^2/day)	18

The St. Marys River Estuary model was calibrated at Interstate 95, where the GA EPD collected discrete water quality data during 2003. Appendix C provides the DO calibration curves plotted with the data from monitoring stations in the listed segments.

4.3 Critical Conditions Model

The critical conditions model was used to assess the dissolved oxygen standard and to determine if problems exist requiring regulatory intervention. Model critical conditions were developed in accordance with GA EPD standard practices (GA EPD, 1978).

Critical water temperatures were determined by examining historic water quality data. The highest summer-time temperature was used to represent each of the listed segments.

Point sources were incorporated into the critical conditions model at their current NPDES permit limits. Although the City of St. Marys – Scrubby Bluff WPCP facility has not begun discharging to Casey Creek under their existing NPDES permit, their permitted limits were used in the critical conditions model. Water quality boundaries, the SOD rate, and all other modeling rates and constants were the same as those in the calibrated model.

4.4 Natural Conditions Model

For the natural conditions models, all point source discharges were completely removed from the critical conditions model. All other model parameters remained the same. This model was used to determine the natural dissolved oxygen concentrations during critical conditions. This model predicted the natural dissolved oxygen concentrations, during the critical summer months, to be less than 5.0 mg/L. Results of the natural condition runs are plotted in the graphs in Appendix C along with the calibration, critical conditions and TMDL results for comparison.

5.0 TOTAL MAXIMUM DAILY LOAD

A Total Maximum Daily Load (TMDL) is the amount of a pollutant that can be assimilated by the receiving waterbody without exceeding the applicable water quality standard. A TMDL is the sum of the individual waste load allocations (WLAs) from point sources and load allocations (LAs) from nonpoint sources, as well as the natural background (40 CFR 130.2) for a given waterbody. The TMDL must also include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the water quality response of the receiving water body (USEPA, 1991). TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measures. For oxygen demanding substances, the TMDL is expressed in lbs/day.

Conceptually, a TMDL can be expressed as follows:

$$TMDL = \Sigma WLAs + \Sigma LAs + MOS$$

This TMDL determines the allowable oxygen demanding load to the listed segment of the St. Marys River. The following sections describe the various oxygen demanding sources which may contribute loads to the TMDL components.

5.1 Waste Load and Load Allocations

The waste load allocation (WLA) is the portion of the receiving water's loading capacity that is allocated to existing or future point sources. WLAs are provided to the point sources from municipal and industrial wastewater treatment systems, as well as permitted storm water discharges. There are two NPDES permitted facilities in the St. Marys River watershed that effect instream dissolved oxygen. Waste load allocations are provided to the point sources from these municipal wastewater treatment systems.

The Georgia ESTUARY critical conditions model was used to determine the WLAs for the discharges upstream from or within the listed segments in order to meet the DO standards. Allocations are based on EPA Dissolved Oxygen Criteria, which states that if the natural dissolved oxygen is less than the standard, then only a 10 percent reduction in the natural condition is allowed. The target limits are defined as 90 percent of the naturally occurring dissolved oxygen concentration at critical conditions and is also the TMDL target.

Table 7 lists the WLAs required to meet the target DO standard. This TMDL requires no reductions in the wasteload allocations. In addition, the ESTUARY model indicates that there is additional assimilative capacity in the St. Marys River segment. However, it should be noted that the SOD rates used in the TMDL allocation models were based on model predictions and may need to be verified before WLAs are implemented.

State and Federal Rules define storm water discharges covered by NPDES permits as point sources. However, storm water discharges are from diffuse sources and there are multiple storm water outfalls. Storm water sources (point and nonpoint) are different than traditional NPDES permitted sources in four respects: 1) they do not produce a continuous (pollutant loading) discharge; 2) their pollutant loading depends on the intensity, duration, and frequency of rainfall events, over which the permittee has no control; 3) the activities contributing to the pollutant loading may include the various allowable activities of others, and control of these activities is not solely within the discretion of the permittee; and 4) they do not incorporate wastewater treatment plants that control specific pollutants to meet numeric limits.

Table 7. St. Marys River Basin WLAs

Facility Name	NPDES Permit No.	Receiving Stream	NPDES Permit Limits			
			Average Monthly Flow (MGD)	Average Monthly BOD_5 (mg/L)	Average Monthly NH_3 (mg/L)	Minimum DO (mg/L)
Canoochee River Basin						
City of Kingland - St. Marys WPCP	GA0037800	St. Marys River	2.2	30	17.4	2
City of St. Marys - Scrubby Bluff WPCP*	GA0037931	Casey Creek	0.5	20[1]	5.0[1]	5

Note:
1 Permit values for the months of May through October.

The intent of storm water NPDES permits is not to treat the water after collection, but to reduce the exposure of storm water to pollutants by implementing various controls. It would be infeasible and prohibitively expensive to control pollutant discharges from each storm water outfall. Therefore, storm water NPDES permits require the establishment of controls or BMPs to reduce pollutants entering the environment.

The Georgia ESTUARY model was run under critical conditions, assuming mid-tide dry weather conditions. Because the critical conditions occur when there are no storm events, no numeric allocation is given to the waste load allocations from storm water discharges associated with MS4s (WLAsw).

The nonpoint source loads for the existing LA and TMDL were computed from the model boundary conditions, which include the stream, tributary, and headwater model boundaries under critical conditions. The partitioning of allocations between point (WLA) and nonpoint (LA) sources shown in Table 8 is based on modeling results and professional judgment.

5.2 Seasonal Variation

The mid-tide, high temperature critical conditions incorporated in this TMDL are assumed to represent the most critical design conditions and to provide year-round protection of water quality. This TMDL is expressed as a total load during the critical low flow period.

5.3 Margin of Safety

The MOS is a required component of TMDL development. As specified by section 303(d) of the CWA, the margin of safety must account for any lack of knowledge concerning the relationship between effluent limitations and water quality. There are two basic methods for incorporating the MOS: 1) implicitly incorporate the MOS using conservative model assumptions to develop allocations, or 2) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations.

For this TMDL, the MOS was implicitly incorporated in the use of the following conservative modeling assumptions:

- Mid-tide conditions;
- High summer temperatures;
- Conservative reaction rates; and
- The assumption that all point sources continuously discharge at their NPDES permit limits for the same critical period.

Table 8. TMDL Loads for the St. Marys River Basin under Critical Conditions

Stream Segment	WLA (lbs/day)	WLAsw (lbs/day)	LA (lbs/day)	TMDL (lbs/day)
St. Marys River – Catfish Creek to Millers Branch	2,917	NA	2,686	5,603

Note: TMDL expressed as Ultimate Oxygen Demand (UOD), which includes the Carbonaceous Biochemical Oxygen Demand (CBOD) and the Nitrogenous Biochemical Oxygen Demand (NBOD).
NA = no storm water discharges associated with MS4s contributing to the listed segment during critical conditions

6.0 RECOMMENDATIONS

6.1 Monitoring

Water quality monitoring is conducted at a number of locations across the State each year. The GA EPD has adopted a basin approach to water quality management that divides Georgia's major river basins into five groups. This approach provides for additional sampling work to be focused on one of the five basin groups each year, and offers a five-year planning and assessment cycle (GA EPD, 1996). The Ochlockonee, Satilla, St. Marys and Suwannee River Basins were the basins of focused monitoring in 2003 and will again receive focused monitoring in 2008.

The revised TMDL Implementation Plan for the listed segment of the St. Marys River will include monitoring plans which describe pertinent current or impending water quality monitoring activities, recommended future monitoring activities, and suggest procedures for coordinating those activities.

6.2 Reasonable Assurance

The GA EPD is responsible for administering and enforcing laws to protect the waters of the State. The TMDL implementation will be conducted using a phased approach. Permitted discharges will be regulated through the NPDES permitting process described in this report. The permittee may be required to perform temperature and dissolved oxygen monitoring upstream and downstream of the point source. If it is determined that the model assumptions need to be modified, the TMDL will be re-evaluated based on the new data collected during critical conditions, and the TMDL will be reallocated.

The GA EPD is the lead agency for implementing the State's Nonpoint Source Management Program. Regulatory responsibilities that have a bearing on nonpoint source pollution include establishing water quality standards and use classifications, assessing and reporting water quality conditions, and regulating land use activities that may affect water quality. Georgia is working with local governments, agricultural, and forestry agencies such as the Natural Resources Conservation Service, the Georgia Soil and Water Conservation Commission, and the Georgia Forestry Commission, to foster the implementation of BMPs that address nonpoint source pollution. In addition, public education efforts are being targeted to individual stakeholders to provide information regarding the use of BMPs to protect water quality.

6.3 Public Participation

A thirty-day public notice period was provided for this TMDL. During that time, the availability of the TMDL was publicly noticed, a copy of the TMDL was provided upon request, and the public was invited to provide comments on the TMDL. This TMDL was modified to address the comments received.

7.0 INITIAL TMDL IMPLEMENTATION PLAN

GA EPD has coordinated with EPA to prepare this Initial TMDL Implementation Plan for this TMDL. GA EPD has also established a plan and schedule for development of a more comprehensive implementation plan after this TMDL is established. GA EPD and EPA have executed a Memorandum of Understanding that documents the schedule for developing the more comprehensive plans. This Initial TMDL Implementation Plan includes a list of BMPs and provides for an initial implementation demonstration project to address one of the major sources of pollutants identified in this TMDL, while State and/or local agencies work with local stakeholders to develop a revised TMDL Implementation Plan. It also includes a process whereby GA EPD and/or Regional Development Centers (RDCs), or other GA EPD contractors (hereinafter, "GA EPD Contractors"), will develop expanded plans (hereinafter, "Revised TMDL Implementation Plans").

This Initial TMDL Implementation Plan, written by GA EPD and for which GA EPD and/or the GA EPD Contractor are responsible, contains the following elements.

1. NPDES permit discharges are a primary source of excessive pollutant loading, where they are a factor. Any wasteload allocations in this TMDL will be implemented in the form of water-quality based effluent limitations in NPDES permits issued under CWA Section 402. [See 40 C.F.R. § 122.44(d)(1)(vii)(B)]. Nonpoint sources are the secondary cause of excessive pollutant loading in most cases. EPA has identified a number of management strategies for the control of nonpoint sources of pollutants, representing some BMPs. The "Management Measure Selector Table" shown below identifies these management strategies by source category and pollutant.

2. GA EPD and the GA EPD Contractor will select and implement one or more BMP demonstration projects for each River Basin. The purpose of the demonstration projects will be to evaluate by River Basin and pollutant parameter the site-specific effectiveness of one or more of the BMPs chosen. GA EPD intends that the BMP demonstration project be completed before the Revised TMDL Implementation Plan is issued. The BMP demonstration project will address the major pollutant categories of concern for the respective River Basin as identified in the TMDLs. The demonstration project need not be of a large scale, and may consist of one or more measures from the Table or equivalent BMP measures proposed by the GA EPD Contractor and approved by GA EPD. Other such measures may include those found in EPA's "*Best Management Practices Handbook*," the *"NRCS National Handbook of Conservation Practices*," or any similar reference, or measures that the volunteers, etc., devise that GA EPD approves. If for any reason the GA EPD Contractor does not complete the BMP demonstration project, GA EPD will take responsibility for doing so.

3. As part of the Initial TMDL Implementation Plan, the GA EPD brochure entitled *"Watershed Wisdom -- Georgia's TMDL Program*" will be distributed by GA EPD to the GA EPD Contractor for use with appropriate stakeholders for this TMDL. Also, a copy of the video of that same title will be provided to the GA EPD Contractor for its use in making presentations to appropriate stakeholders on TMDL Implementation Plan development.

4. If for any reason the GA EPD Contractor does not complete one or more elements of a Revised TMDL Implementation Plan, GA EPD will be responsible

for getting that (those) element(s) completed, either directly or through another contractor.

5. The deadline for development of a Revised TMDL Implementation Plan is the end of December 2006.

6. The GA EPD Contractor helping to develop the Revised TMDL Implementation Plan, in coordination with GA EPD, will work on the following tasks involved in converting the Initial TMDL Implementation Plan to a Revised TMDL Implementation Plan:

   A. Generally characterize the watershed;
   B. Identify stakeholders;
   C. Verify the present problem to the extent feasible and appropriate (e.g., local monitoring);
   D. Identify probable sources of pollutant(s);
   E. For the purpose of assisting in the implementation of the load allocations of this TMDL, identify potential regulatory or voluntary actions to control pollutant(s) from the relevant nonpoint sources;
   F. Determine measurable milestones of progress;
   G. Develop a monitoring plan, taking into account available resources, to measure effectiveness; and
   H. Complete and submit to GA EPD the Revised TMDL Implementation Plan.

7. The public will be provided an opportunity to participate in the development of the Revised TMDL Implementation Plan and to comment on it before it is finalized.

8. The Revised TMDL Implementation Plan will supersede this Initial TMDL Implementation Plan once GA EPD approves the Revised TMDL Implementation Plan.

Management Measure Selector Table

Land Use	Management Measures	*Fecal Coliform*	*Dissolved Oxygen*	*pH*	*Oxygen demanding substances*	*Temperature*	*Toxicity*	*Mercury*	*Metals (copper, lead, zinc, cadmium)*	*PCBs, toxaphene*
Agriculture	1. Oxygen demanding substances & Erosion Control	–	–		–	–				
	2. Confined Animal Facilities	–	–							
	3. Nutrient Management	–	–							
	4. Pesticide Management		–							
	5. Livestock Grazing	–	–		–	–				
	6. Irrigation		–		–	–				
Forestry	1. Preharvest Planning				–	–				
	2. Streamside Management Areas	–	–		–	–				
	3. Road Construction & Reconstruction		–		–	–				
	4. Road Management		–		–	–				
	5. Timber Harvesting		–		–	–				
	6. Site Preparation & Forest Regeneration		–		–	–				
	7. Fire Management	–	–	–	–	–				
	8. Revegetation of Disturbed Areas	–	–	–	–	–				
	9. Forest Chemical Management		–			–				
	10. Wetlands Forest Management	–	–	–		–		–		

Land Use	Management Measures	*Fecal Coliform*	*Dissolved Oxygen*	*pH*	*Oxygen demanding substances*	*Temperature*	*Toxicity*	*Mercury*	*Metals (copper, lead, zinc, cadmium)*	*PCBs, toxaphene*
Urban	1. New Development	–	–		–	–			–	
	2. Watershed Protection & Site Development	–	–		–	–		–	–	
	3. Construction Site Erosion and Oxygen demanding substances Control		–		–	–				
	4. Construction Site Chemical Control		–							
	5. Existing Developments	–	–		–	–			–	
	6. Residential and Commercial Pollution Prevention	–	–							
Onsite Wastewater	1. New Onsite Wastewater Disposal Systems	–	–							
	2. Operating Existing Onsite Wastewater Disposal Systems	–	–							
Roads, Highways and Bridges	1. Siting New Roads, Highways & Bridges	–	–		–	–			–	
	2. Construction Projects for Roads, Highways and Bridges		–		–	–				
	3. Construction Site Chemical Control for Roads, Highways and Bridges		–							
	4. Operation and Maintenance-Roads, Highways and Bridges	–	–			–			–	

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APPENDIX A

Water Quality Data

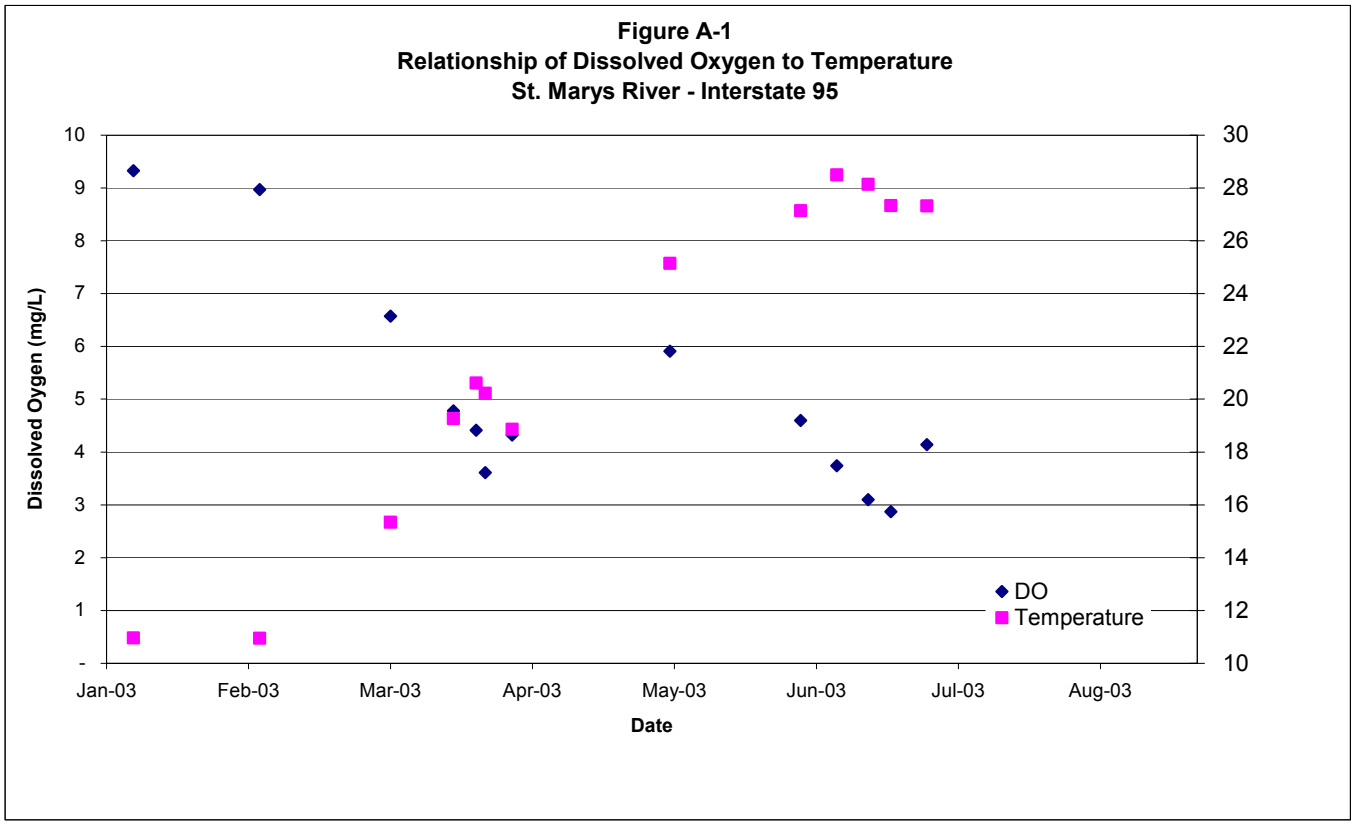


Table A-1. Data for Figure A-1

Date	Dissolved Oxygen (mg/L)	Water Temperature (deg C)
07-Jan-03	9.33	10.96
04-Feb-03	8.97	10.95
05-Mar-03	6.57	15.34
19-Mar-03	4.78	19.27
24-Mar-03	4.41	20.61
26-Mar-03	3.61	20.23
01-Apr-03	4.32	18.86
06-May-03	5.91	25.14
04-Jun-03	4.60	27.14
12-Jun-03	3.74	28.50
19-Jun-03	3.10	28.14
24-Jun-03	2.87	27.33
02-Jul-03	4.14	27.32

APPENDIX B

Model Structure

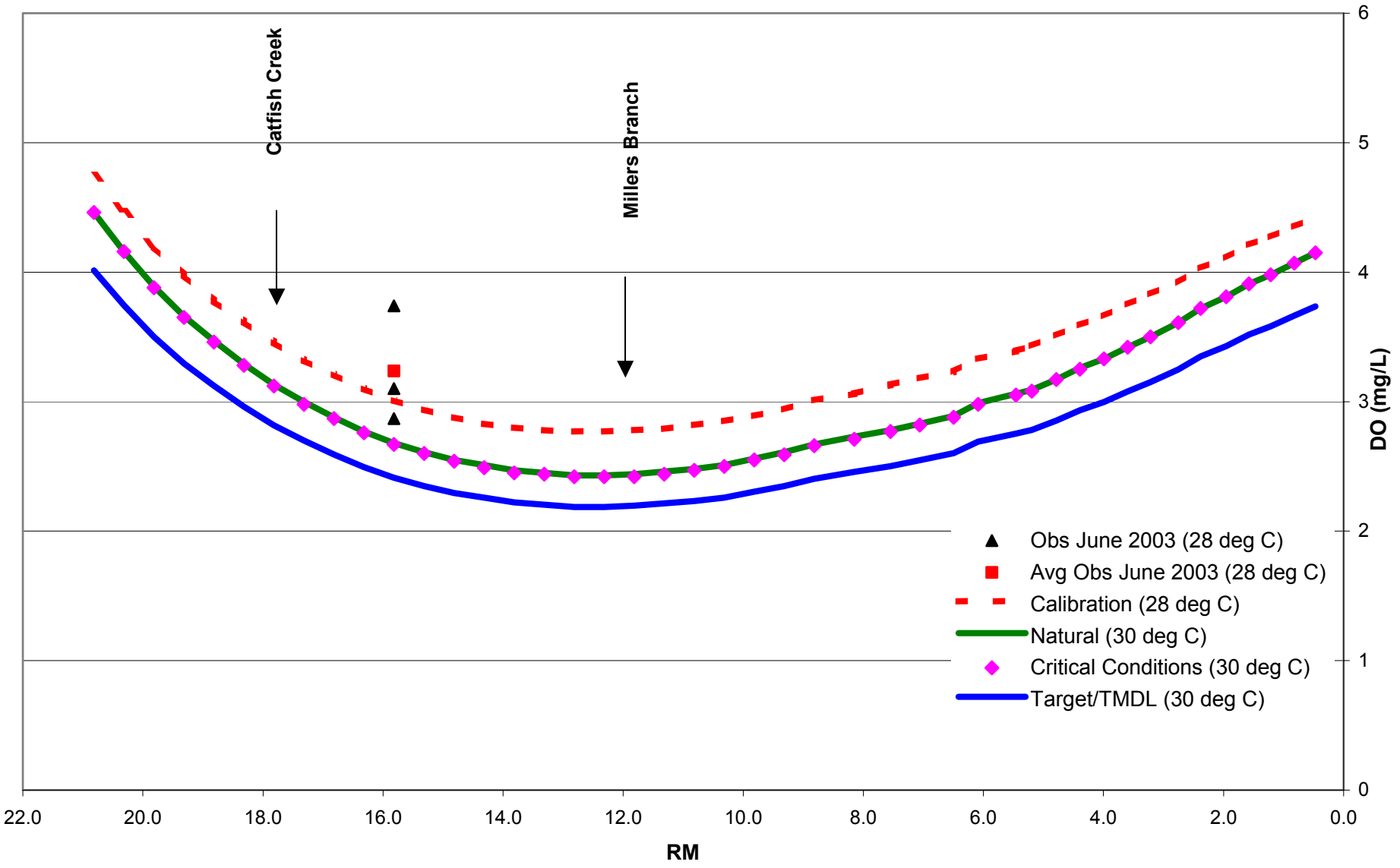
Table B-1. St. Marys River Estuary Model Structure

Segment	Segment Name	Reach Length (feet)	Volume (million gallons)	Depth (ft)
1	USGS 02231253 at RM 21.1	2640	177.8	15.0
2	St. Marys at RM 20.5	2640	177.8	15.0
3	St. Marys at RM 20.0	2640	177.8	15.0
4	St. Marys at RM 19.5	2640	192.6	15.0
5	St. Marys at RM 19.0	2640	207.4	15.0
6	St. Marys at Kingsland WPCP outfall	2640	213.3	16.0
7	St. Marys above Catfish Creek RM 18	2640	205.4	16.0
8	St. Marys at RM 17.5	2640	213.3	16.0
9	St. Marys at RM 17.0	2640	221.2	16.0
10	St. Marys at RM 16.5	2640	213.3	16.0
11	St. Marys at I-95 RM 16.0	2640	218.2	17.0
12	St. Marys above Casey Creek RM 15.5	2640	226.6	17.0
13	St. Marys at RM 15.0	2640	235.0	17.0
14	St. Marys above Sister Cks RM 14.5	2640	235.0	17.0
15	St. Marys at RM 14.0	2640	235.0	17.0
16	St. Marys at RM 13.5	2640	311.1	17.5
17	St. Marys at RM 13.0	2640	380.2	17.5
18	St. Marys above Millers Brch RM 12.5	2640	345.6	17.5
19	St. Marys at RM 12.0	2640	311.1	17.5
20	St. Marys at RM 11.5	2640	293.8	17.5
21	St. Marys at RM 11.0	2640	276.5	17.5
22	St. Marys at RM 10.5	2640	276.5	17.5
23	St. Marys at RM 10.0	2640	276.5	17.5
24	St. Marys at RM 9.5	2640	320.0	18.0
25	St. Marys below Sta. M7 at RM 8.82	3510	492.7	17.8
26	St. Marys at RM 8.15	3200	487.2	19.2
27	St. Marys below Sta. M6 at RM 7.55	2560	399.8	18.6
28	St. Marys at RM 7.06	2970	520.4	16.7
29	St. Marys above Burrell's Ck RM 6.5	2180	344.1	19.2
30	Between Bell/Burrell below Sta. M5	3310	580.5	18.7
31	Below Bells River at RM 5.46	1390	309.6	22.2
32	St. Marys at RM 5.2	2170	453.1	29.8
33	St. Marys at RM 4.78	2050	361.0	18.0
34	Above St. Marys Dock RM 4.4	2130	420.1	21.0
35	Below St. Marys Dock above Sta. M4	2090	422.0	16.2
36	St. Marys at RM 3.6	1990	408.2	19.2
37	St. Marys at RM 3.22	2470	504.6	17.5
38	St. Marys at RM 2.75	1950	358.2	17.9
39	Above St. Marys WTF RM 2.33	2260	495.0	21.2
40	Above North Riv. & Sta. M3	1990	492.0	23.7
41	Below North Riv. at RM 1.56	1920	435.6	15.7
42	St. Mary at RM 1.21	2060	419.2	16.3
43	Below Sta. M2 & Pt. Peter Pier	1870	442.7	20.0
44	St. Marys at RM 0.47	2480	583.5	15.2
45	St. Marys at Sta. M1 & Cumbl. Sound	-	-	-

APPENDIX C

Calibration, Critical Conditions, Natural Conditions, and TMDL Model Curves

Figure C-1
DOSAG Model Results
St. Marys River



APPENDIX D

Daily Oxygen Demanding Substances Load Summary Memorandum

SUMMARY MEMORANDUM
Average Annual Oxygen Demanding Substances Load
St. Marys River

1. 303(d) Listed Waterbody Information

State: Georgia
County: Camden

Major River Basin: St. Marys
8-Digit Hydrologic Unit Code(s): 03070204

Waterbody Name: St. Marys River
Location: Catfish Creek to Millers Branch
Stream Length: 6 miles
Watershed Area: 1,360 square miles
Flows into: Atlantic Ocean
Ecoregion: Atlantic Coast Flatwoods

Constituent(s) of Concern: Dissolved Oxygen

Designated Use: Fishing (not supporting designated use)

Applicable Water Quality Standards:

A daily average of 5.0 mg/L and no less than 4.0 mg/L at all times for waters supporting warm water species of fish.

***Natural Water Quality*. It is recognized that certain natural waters of the State may have a quality that will not be within the general or specific requirements contained herein. These circumstances do not constitute violations of water quality standards. This is especially the case for the criteria for dissolved oxygen, temperature, pH and fecal coliform. NPDES permits and Best Management Practices will be the primary mechanisms for ensuring that the discharges will not create a harmful situation.**

2. TMDL Development

Analysis/Modeling: Georgia Estuary – Steady state tidally averaged water quality model developed by Georgia Environmental Protection Division.

Calibration Data: Georgia EPD field data from summer 2003.

Critical Conditions:
(1) Mid-tide conditions;
(2) High summer temperatures, based on historic water quality data;
(3) Conservative reaction rates; and
(4) Incorporation of point sources discharging at their NPDES permit limits.

3. Allocation Watershed/Stream Reach:

Wasteload Allocations (WLA):	**2,917 lbs/day**
Wasteload Allocations (WLAsw):	**NA**
Load Allocation (LA):	**2,686 lbs/day**
TMDL	**5,603 lbs/day**

*** TMDL expressed as Ultimate Oxygen Demand (UOD), which includes Carbonaceous Biochemical Oxygen Demand (CBOD) and Nitrogenous Biochemical Oxygen Demand (NBOD).**

Margin of Safety (MOS): **Implicit, based on the following conservative assumptions:**
(1) Mid-tide conditions;
(2) High summer temperatures, based on the historical record, persist for the same critical period;
(3) Conservative reaction rates; and
(4) All point sources discharge continuously at their NPDES permit limits for the same critical period.